

Propulsion Test Support Analysis with GPU Computing, Phase I

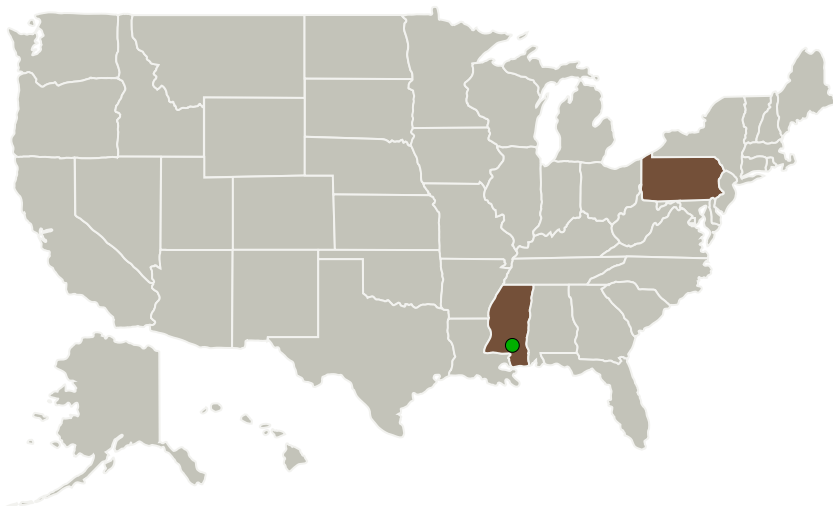
Completed Technology Project (2012 - 2012)



Project Introduction

The design, development and staging of tests to certify liquid rocket engines usually require high-fidelity structural, fluid and thermal support analysis. These analyses are crucial to a successful engine test program since pressurization requirements, heat loads, cooling requirements and structural stresses are evaluated. Furthermore, these analyses are utilized to detect anomalies, unsteady pressure pulsations, structural vibrations, resonant modes and unexpected plume impingement zones that may be hazardous to the test stand structure and/or the test article. Such high-fidelity analyses have traditionally been performed on PC-cluster type computational platforms spanning over days/weeks given the complexity of the flowpath and flow regimes typically involved in the testing of liquid rocket engines. In this proposal we exploit the data parallelism of the computational algorithms involved to significantly enhance performance on low-cost high-speed GPU enabled hardware. Such a transition to GPU-based hardware will result in a paradigm shift for compute-intensive propulsion system applications from expensive CPU dominated PC-cluster architectures to economical workstation styled hybrid GPU-CPU systems, while resulting in dramatic decreases in turnaround times.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
CRAFT Tech - Combustion Research and Flow Technology	Lead Organization	Industry	Pipersville, Pennsylvania
● Stennis Space Center(SSC)	Supporting Organization	NASA Center	Stennis Space Center, Mississippi

Primary U.S. Work Locations	
Mississippi	Pennsylvania

Project Transitions

**February 2012:** Project Start**August 2012:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/138428>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

CRAFT Tech - Combustion Research and Flow Technology

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Vineet Ahuja

Co-Investigator:

Vineet Ahuja

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Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.1 In-space Propellant Storage & Utilization

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System